

Robots that shoot still lifes, Acumé's hi-tech crime scene investigations and the mission to photograph Saturn feature in this month's tech-themed Intelligence section. Plus we have two reports from Photokina, and we take a closer look at *The Times*' new photography-rich iPad app.

Body mapping Actual photographs of the deceased are mapped onto a 3D model by Acumé Forensics. A graphic image such as this [right] is permissible in court, whereas actual photographs may be deemed to be too distressing for a jury, plus crime scene photographs can be misleading. Also, a crime scene may have been compromised by the police or paramedics who, in their rescue attempts, have moved furniture and repositioned the body, making subsequent photographs of the scene confused. Images © Acumé Forensics.

PROFILE

Criminal minded

The Soham Murders is just one high-profile case Acumé Forensics has helped to crack using photography, computer-generated imagery and 3D techniques to help solve crimes. **Mark Wood** profiles the Leeds-based company.

"Everyone's interested in what we do," says Stephen Cole of Acumé Forensics, and that's no empty boast. The company has helped secure guilty verdicts in scores of police trials using pioneering digital techniques that have fast become accepted practice.

Mike Dixon and Stephen Cole set up Acumé in 2004, along with former police officers, George Phillips and Mark Illingworth. Dixon and Cole had previously worked together at the West Yorkshire Police's Digital Imaging Unit, where they produced one of the first fully interactive courtroom presentations in the UK for Cambridgeshire Police in the Soham murder trial at the Old Bailey.

The company is privately owned and therefore free to explore all aspects of digital technology, working for clients including the Ministry of Defence, the Health and Safety Executive, the Procurator Fiscal and other forensic agencies besides individual police forces.

"Our independence allows us to work with all forces and other agencies, so we can share our experience, letting colleagues know what processes can be used in court," says Cole. "We're pushing the boundaries all the time."

Acumé's work is highly confidential, so the examples in this article have been abstracted –



writing anything too specific could cause convictions to be reviewed and even quashed, long after the event. Put simply, the team uses 3D modelling to recreate crime scenes or events, placing virtual cameras in positions that would be impossible in real life. One case involved recreating a 20-year-old murder scene, for example, using contemporary measurements of the still-intact building and adding details found in photographs and video shot for the initial investigation. The archived fingerprint lifts were then put into position by overlaying their textured pattern onto the original woodchip wallpaper, discovered on stud walls built after the crime had taken place. This allowed Acumé to show the likely hand positions of the person leaving the fingerprints.

Acumé also helps juries comprehend expert statements, translating the highly scientific

language used by pathologists or forensic scientists into images.

A periorbital haematoma, for example, is more generally known as a black eye, but not only can Acumé show a black eye on a 3D subject, they can show how severe the injury was and any other wounds, something that can otherwise take many hours of complicated testimony. Acumé also works closely with pathologists to reconstruct crime scenes, and build up the sequence of events that led to the incident under investigation.

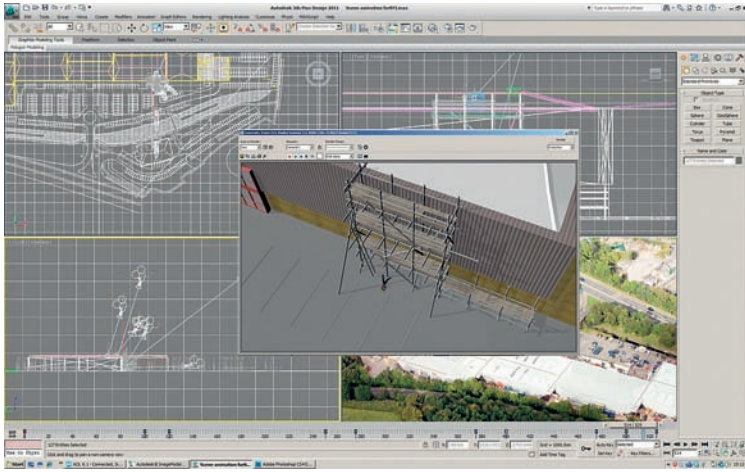
Computer models of body maps and crime scenes have to be very accurate, and are only used in court if the case pathologist has signed them off. This can mean they look quite empty, as the pathologist will only include information they deem necessary (and for which there is evidence). Lighting is included to help the jury understand shape and depth, but it must not be emotive

– something that is often hard to avoid in straight photography.

Scene of crime

Photogrammetry is the art, science and technology of making measurements from photographs, and it has its origins in the 19th century. Advances in digital imaging mean that inexpensive cameras and software can also be used these days, and Acumé uses a further evolution of the process known as forensics geomatics, which combines 3D scanning with photogrammetry to reconstruct long-gone scenes. A more exacting definition of the process is "the acquisition, presentation, analysis and management of spatially referenced data (ie data identified according to their location) in the service of justice".

In one murder case, Acumé analysed then presented a vast amount of CCTV footage gathered



3D reconstructions show the position of a body in relation to scaffolding for use in a corporate manslaughter case.

by several surveillance systems in and around a city centre. The murder had actually been caught by one of the cameras, but the individuals involved were so far away that they were only a few pixels high in the footage. By analysing the other CCTV systems, where the individuals were identifiable, Acumé was able to convert and process the video codecs from the multiple systems into a single annotated edit. This edit, which could easily be understood by a jury, traced the movements of those involved and led to a conviction.

Acumé's strength is twofold: lateral thinking and technical expertise. Using a myriad of software packages and specialist plug-ins, often scripted with bespoke code written by Dixon, they can create scenes using 2D still images and video footage without resorting to 3D Cad-based software. Other software can make 3D meshes from 2D images, creating 3D pixels. This three-dimensional point-cloud data is ideal for making very accurate measurements over large distances, helping to pinpoint a suspect's height or the speed of a

vehicle caught on CCTV. This work can help the CPS bring charges, where once there would have been insufficient evidence.

Once in court, Acumé's interactive multimedia presentations allow digital video media, images, panoramas and audio material to be analysed frame-by-frame, zoomed and scrolled, helping avoid the accusation that evidence has been arranged into a narrative. "Our work has to be objective, otherwise it would not stand up in court," says Dixon. "It's all about bare facts."

But Acumé also works on the space between fact and fiction by advising TV shows on how to reconstruct crime scenes, and it was recently commissioned by *National Geographic* and ITN Productions to help reconstruct the ultimate "cold case", Jack the Ripper. Acumé used 3D graphics to reconstruct the injuries the Ripper inflicted on his victims, and produced a virtual autopsy. This illustrated where the organs are located in the body and showed how difficult it would be to remove parts such as the liver in the poor light in which Ripper supposedly

worked. The program will air in the US next spring.

Acumé uses other techniques too, including enhancing poor audio recordings taken covertly and lip reading conversations captured on CCTV. Using all the means at its disposal, the team has helped lock criminals away for a total of 850 years, and the company proudly links to news stories on all the cases it has been involved with. With headlines such as "Man drove over fiancée's head", the hard reality of Acumé's work can leave you cold. *BJP*

www.acumeforensic.com